USING MICROBES TO PROCESS COAL

The United States derives 56 percent of its electricity from coal. Worldwide, people rely on coal for 25 percent of their energy use. Burning coal often produces sulfur dioxide and nitrogen oxide, which contribute to acid rain. The 1990 Clean Air Act requires utilities to reduce their sulfur dioxide and nitrogen oxide emissions in half by the year 2000. Coal burning also produces trace elements - such as arsenic, mercury, and selenium — that are precursors to hazardous air pollutants (HAPs). Soon, HAPs emissions will also have to be reduced.

Researchers at the Idaho National Engineering and Environmental Laboratory have developed a technology that combines microbial action with a physical method to separate pyrite and other minerals — which contain sulfur, arsenic, mercury, selenium, and other pollutants — from coal before it's burned. The physical method removes the large pyritic inclusions and minerals, while microbes oxidize the small bits of pyrite measuring about 250 microns in diameter. Although rapid physical coal cleaning is done routinely in preparation plants, biochemical processes to remove pollutants offer deeper cleaning, more specificity and less coal loss. For hard-to-clean coals - those with micropyrite less than 10 microns — this process recovers 90 percent of the organic fraction of coals, at half the cost of using only the physical grinding process.

The technology uses a slurry column bioreactor process. INEEL researchers conducted tests in 40-liter and 200-liter reactors. Large pyrite and mineral particles went through two stages of physical separation followed by two days of microbial degradation. These bioreactors also served as settlers for coal/water separation, to minimize the volume of water used and waste water generated. Sixty-seven percent of the pyrite was removed from a 60 mesh Pittsburgh #8 coal, at a 35 percent slurry concentration and a two-day reactor residence time. Ninety percent of the heating value of the feed coal was recovered. Over half the selenium, arsenic and mercury were removed from the coal.

INEEL researchers are pursuing a one-ton-per-day pilot plant test. They also plan to optimize the slurry column process, which shows promise over other physical cleaning techniques in eliminating mercury. Microbes make mercury

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more susceptible to physical removal, which existing physical cleaning techniques have difficulty doing. The process also removes mercury before combustion. Other HAP-reduction technologies are applied post-production, and still emit volatile mercury.

INEEL researchers' goal is to have a tested technology available to reduce HAP production by the time the coal industry must comply with the progressively stringent clean-air regulations. They believe that it will be especially useful for those Third World countries that rely principally on coal for energy, and have no or few alternative energy sources.

For information contact:

Jerry L. May
e-mail: jlm@inel.gov
Phone: (208) 526-6674

John Alexander
e-mail: jala@inel.gov
Phone: (208) 526-0849